RUSH SKELETONWEED

A Threat to Montana's Agriculture

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Rush skeletonweed *(Chondrilla juncea)* is an exotic, tap-rooted, perennial noxious weed which infests millions of acres in the Pacific Northwest and California. In Montana, rush skeletonweed has invaded Sanders and Lincoln counties (Figure 1) and has the potential to disrupt the agriculture industry by dominating productive crop and grazing land. This weed thrives on well drained, sandy textured or rocky soils, along roadsides, in rangelands, pastures and grain fields.

Origin, History and Distribution

Rush skeletonweed is native to Asia Minor and the Mediterranean region, including North Africa. It has successfully invaded Australia, Argentina, Italy, Lebanon, New Zealand, Portugal, Spain, the United States and the former Yugoslavia. Rush skeletonweed was first reported in the United States near Spokane, Washington in 1938. It was found in Idaho and Oregon during the 1960s, and currently infests over 6.2 million acres of rangeland in the Pacific Northwest and California. A small infestation was found in Sanders County, Montana, in 1991. A year later, several small infestations were found in Lincoln County. In 1994, several new infestations were found in both counties. It appears that this weed is moving quickly in western Montana.

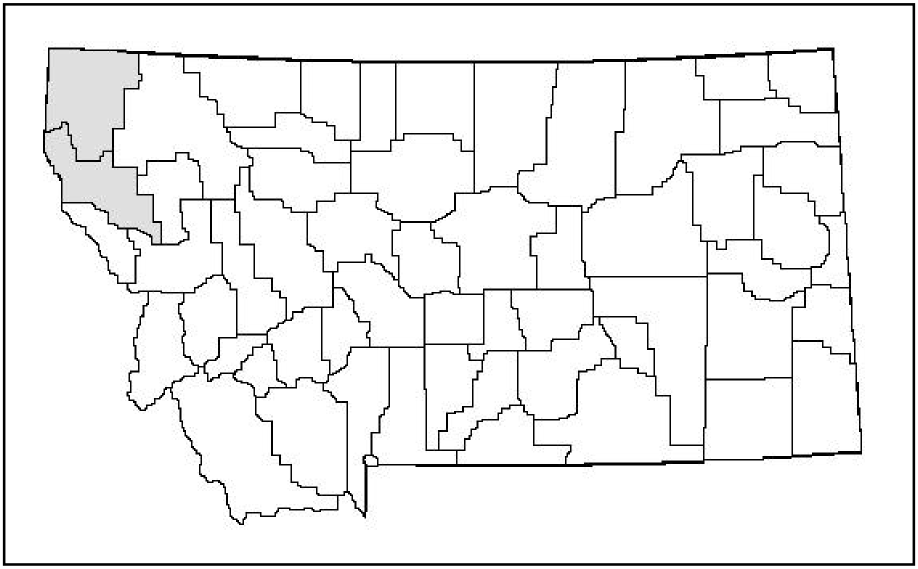

Figure 1. Rush skeletonweed has invaded Lincoln and Sanders counties in Montana's northwest corner. Weed infestations in this area often spread quickly to the rest of the state.

Detrimental Impacts

According to one study, rush skeletonweed reduced wheat yield 80 percent in southeastern Australia. Rush skeletonweed competes for soil moisture and nutrients (primarily nitrogen), and the wiry stem interferes with harvesting. On rangeland, rush skeletonweed can form dense monocultures. It displaces indigenous plants, dramatically reduces rangeland forage production and threatens the cattle industry. This species spreads from rangeland to adjacent cropland.

Beneficial Impacts

In Australia, rush skeletonweed is a drought-tolerant pasture plant. It is palatable and nutritious for sheep in the rosette and early flowering stage and has become a grazed component of low quality pastures in many parts of southeastern Australia. When rain is adequate, this species can be a major source of pollen for honeybees.

Figure 2. Rosette of rush skeletonweed

Figure 3. The plant's skeleton-like appearance gives it its name.

Figure 4. Stiff, downward-pointing hairs on the first six inches of the stem are a key identifying characteristic of rush skeletonweed.

Identification and Life-Cycle

Rush skeletonweed is a herbaceous, relatively long-lived perennial member of the sunflower family. Its life-cycle begins in the fall with seed germination and seedling establishment as well as regrowth from perennial roots. Plants usually overwinter as rosettes which closely resemble common dandelion *(Taraxacum officiale)* (Figure 2). The hairless basal leaves are 2 to 5 inches long and 1/2 to 2 inches wide. Rush skeletonweed grows whenever temperatures are above freezing, but usually initiates rapid spring growth in March or April.

During late spring, a spindly stem elongates from the center of the rosette reaching 1 to 4 feet tall. At this time, the basal leaves have deep, irregular teeth that generally point backward toward the stem base. The stem has a few narrow, inconspicuous leaves, giving the plant a skeleton-like appearance (Figure 3). An important characteristic of rush skeletonweed is the stiff downward-pointing hairs on the lower 4 to 6 inches of the stem (Figure 4). The remainder of the stem is relatively smooth or has a few rigid hairs. All plant parts, including the leaf, stem and roots, exude a milky latex when cut or broken (Figure 5).

Flowering begins in early summer and continues until fall along with seed development. The bright yellow flowers develop along the stem and branch tips,

Figure 5. A milky latex appears when plant parts are broken or cut.

Figure 6. Flower and seed heads

Figure 7. Seeds of rush skeletonweed

either singly or in clusters of two to five flower heads. Although flower heads are less than 1 inch in diameter, and appear as a single flower, they consist of nine to 12 flowers. (Figure 6). Seeds mature nine to 15 days after flowers open. An individual plant is capable of producing over 20,000 seeds, but first year plants usually produce from 250 to 350 seeds. The light brown or black ribbed, pappus-bearing seeds grow to about $^{1}/_{8}$ inch in length (Figure 7). These seeds are dispersed by wind to open sites, while parent plants die back to the soil surface. This life-cycle is repeated with the arrival of fall precipitation.

Biology and Ecology

Habitat and Plant Communities

Cool winters and warm summers with winter and spring rainfall—but without severe drought—are optimum conditions for the growth and reproduction of rush skeletonweed. Summer temperatures reaching 59°F appear to be necessary for flower and seed production, but seed production can be limited by drought.

Rush skeletonweed can flourish in very dry to very wet environments—it is established in habitats from 9 to 59 inches of annual precipitation. Much like spotted knapweed, it dominates disturbed areas where it is established, such as roadways, waste areas, and areas weakened by drought or improper grazing. Big sagebrush/needle and threadgrass, bluebunch wheatgrass/Sandberg’s bluegrass, and bitterbrush/bluebunch wheatgrass are some of the habitat types in Montana

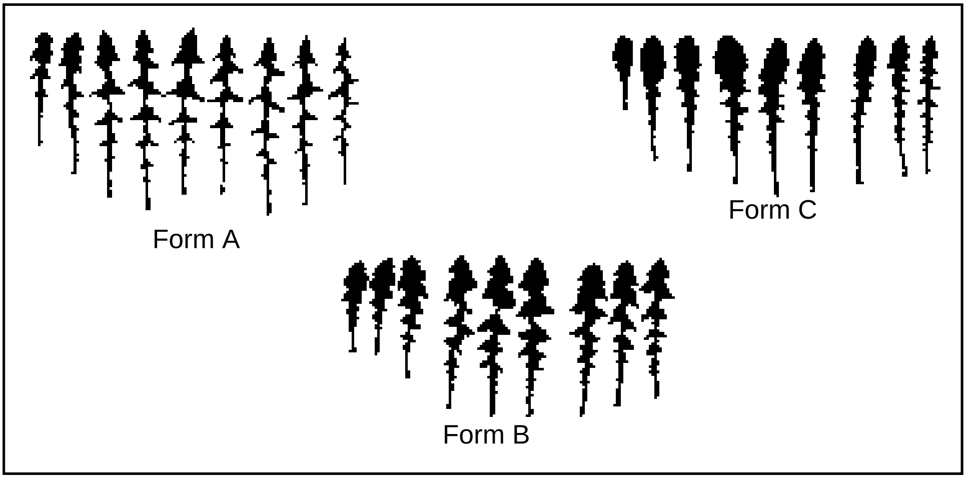

Figure 8. Three forms of rush skeletonweed.

that are susceptible to invasion by rush skeletonweed. Good condition native vegetation is seldom invaded by rush skeletonweed.

Variability

While more than 300 morphologically distinct forms of rush skeletonweed have been recognized in Australia, there are only three which are widespread in the United States. These forms, designated A, B and C, have narrow, intermediate and broad rosette leaves, respectively (Figure 8). Rush skeletonweed also differs in shape and form of flowers, fruit characters, potential for regrowth from roots and susceptibility to specific biological and chemical controls.

Germination and Emergence

Rush skeletonweed seeds display virtually no dormancy. Seeds germinate within 24 hours under optimal conditions (59–86°F). Buried seeds germinate within a year or two even if less than 0.3 inches of rain falls at one time. However, seedlings require continuous rainfall for three to six weeks for successful establishment. During drought, most seedlings die without emerging.

Roots

Rush skeletonweed roots often reach depths of 8 feet in soil with little lateral growth, except in very sandy or gravely soils where lateral roots are formed. When rush skeletonweed roots are severed, they produce shoots which can reach the soil surface from depths of up to 4 feet. Taproot cuttings as small as $^1/_2$ inch

Figure 9. Rush skeletonweed reduces plant diversity and grazing capacity.

wide and 1 inch in length can produce new plants under moist conditions. In general, the ability of shoots to emerge from roots increases with the size of root fragments, but decreases with depth of burial.

Managing Rush Skeletonweed

In Montana, managing rush skeletonweed should focus on **prevention** and **eradication**. Existing infestations should be eradicated with diligence. Once the weed becomes widely established, an integrated strategy of cultural, chemical and biological controls should be implemented to reduce the frequency of the weed to manageable levels.

Preventing Rush Skeletonweed Invasion

Rush skeletonweed infestations dominate the panhandle region of Idaho. This situation teaches us to vigorously prevent further encroachment. By implementing an intensive prevention program, we may be able to keep rush skeletonweed from further encroachment into Montana.

In order to prevent rush skeletonweed invasion, seed production and dispersal must be stopped. Seeds are dispersed mainly by wind, water, trains, vehicles and machinery. It is important to refrain from driving vehicles and machinery through rush skeletonweed infested areas during the seeding period, and to wash the undercarriage of vehicles and machinery before leaving infested areas. Livestock should not graze weed infested areas during seed formation.

Before being moved to weed-free range, livestock grazing infested ranges should be transported to a holding area for 10 to 14 days.

Recreationists spread weed seeds. To prevent seed spread, campers, hikers, off-road vehicle enthusiasts and horseback riders should brush and clean equipment and animals. Weedy plant material should be placed into a hot fire before leaving an area.

Proper livestock grazing is essential to maintain competitive grass stands, which will help limit rush skeletonweed encroachment. A grazing management plan should be developed for any management unit involved in a rush skeletonweed prevention program. Management should include altering the season of use and stocking rates to achieve proper grass utilization. Grazing systems should include altering the season of use, rotating livestock to allow plants to recover before being regrazed and allowing plant litter to accumulate so that nutrients recycle into the soil.

An integral part of any weed prevention program is to contain neighboring weed infestations. It is critical rush skeletonweed be contained along highways, railways and waterways (weed dispersal corridors) preventing seed transportation into Montana. This requires annual applications of picloram (Tordon 22K).

Detecting new infestations and implementing eradication programs is the second step to preventing the invasion of rush skeletonweed into Montana. Systematic surveys along weed dispersal corridors are necessary to detect weed infestations early. Once an infestation is found, an eradication plan should be designed and implemented which includes an outline of the infestation boundaries, control treatments, control schedule, revegetation plans, follow-up monitoring and costs.

Controlling Rush Skeletonweed

Mechanical Control

Diligent hand pulling or grubbing can provide effective control of very small infestations. Successful hand pulling requires removal of plant growth two or three times per year for six to 10 years because new plants will emerge from severed roots and buried seeds. Removing rush skeletonweed plants is best accomplished when the soil is wet. Plants should be destroyed by burning in a very hot fire to ensure seed and root kill.

Mowing and cultivation are ineffective methods for controlling rush skeletonweed. Mowing does not affect carbohydrate reserves, and only limits seed production in very dry years. Cultivation spreads root fragments and may actually increase the infestation.

Cultural Control

Planting competitive legumes, such as alfalfa *(Medicago sativa)*, has increased soil fertility and effectively reduced populations of rush skeletonweed in crop-pasture rotations. Dense stands of legumes compete for soil moisture and shade rush skeletonweed plants. However, the level of pasture management needed to effectively control the weed is difficult to achieve. Integrating competitive plantings with biological controls has proven effective in Australia.

Proper grazing by sheep can reduce or prevent production of rush skeletonweed rosettes and seed. Continuous, rather than rotational grazing, produces the lowest densities of the weed. Moderate grazing is as effective as heavy grazing in controlling rush skeletonweed because heavy grazing decreases the competitive ability of desired species. Integrating the use of competitive plantings, sheep grazing and biological control agents appears to have potential for managing rush skeletonweed infestations.

Chemical Control

Rush skeletonweed is difficult to control using herbicides. Successful chemical control depends on specific conditions of the site and usually requires an aggressive re-application program. Historically, picloram (Tordon 22K) has been applied at 2 quarts per acre to rosettes to control rush skeletonweed. An application of 2,4-D amine at a rate of 2 quarts per acre provides some control. In Idaho, picloram (Tordon 22K, 1 quart per acre) plus 2,4-D (2 quarts per acre) gave the best control. In Australia, recent studies showed that a single application of clopyralid (Stinger®, 1.5 pints per acre) reduced rush skeletonweed shoots approximately 60 percent three years after application. Mixing clopyralid (Stinger®, 1.5 pints per acre) with dicamba (Banvel DMA® 2 quarts per acre) gave the best long term control, reducing the number of shoots 75 percent three years after application. Annual applications were necessary to provide 95 percent control of rush skeletonweed. Herbicides are most effective when applied to plants that are infected with biological control agents.

High rates of nitrogen fertilizer minimized the effect of rush skeletonweed upon both wheat and pasture yields under moist conditions. Nitrogen increased the size of rush skeletonweed plants, but density decreased. Apparently, nitrogen reduces weed density by increasing competition.

Biological Control

Three biological control agents have been released for control of rush skeletonweed in North America—a rust, a mite and a midge. The rust, *Puccinia chondrilla,* infects Form A of skeletonweed causing pustules that erupt through the leaf and stem surface which reduces the plant's ability to photosynthesize and desiccates the leaves (Figure 10). Severe rust infections can control Form A of rush skeletonweed, while light infections reduce seed production and viability.

The rust spores are carried by wind and rain. The disease moved about five miles within four of its own generations and 200 miles after 12 generations. The spores can be collected and released on new weed infestations. Spores require six hours of both dew and darkness to germinate and establish a rust infection.

Several strains of rust specific to Form B have been collected; however, they have not proven effective under field conditions.

The gall mite, *Aceria chondrillae,* induces the vegetative and floral buds to form leafy galls causing stunting of the plant and greatly reducing seed production. This small parasite is the most damaging of the three biological control agents, but is only effective on Form A plants. The gall overwinters in the central bud of the rosettes without inducing gall formation. As the stem elongates, the mites colonize newly formed floral buds. As females reproduce, the galls swell. As the gall dries, the mites emerge and crawl to other buds or rush skeletonweed plants. The plant can be covered with as many as 4000 galls when four or five generations of the insect occur per year.

The only biological control agent which attacks all three forms of rush skeletonweed is the gall midge *(Cystiphora scmidti).* The midge deforms plants and reduces seed production by feeding on the rosettes, stem leaves and stems of

Figure 10. Rust-infected rosettes

rush skeletonweed. The gall midge overwinters in the rosettes, emerges in April and is active through October. Females lay eggs in plant tissue, which cause some obstruction of nutrient movement within the plant. Despite a relatively short generation time, the gall midge impact is less than either the rust or mites, and their sensitivity to climatic variation is high. Therefore, the gall midge may not overwinter well in Montana.

Integrated Weed Management

Because no single treatment provides long-term control of rush skeletonweed, an integrated strategy must be adopted. The first line of defense is to prevent introductions of the weed. Systematic surveys, early detection and the implementation of an eradication program on small infestations is the second line of defense. Once the weed becomes established, integrating various combinations of competitive plantings, crop-pasture rotations, sheep grazing, biological control agents, herbicides and possibly fertilizers can reduce rush skeletonweed to manageable levels. **The key component of any successful weed management program is sustained effort, constant evaluation and the adoption of improved strategies.**

Rush skeletonweed is a threat to Montana’s agriculture. Because it is a Category III noxious weed, the primary goals are: awareness, prevention, early detection and eradication. **If you suspect that you have seen rush skeletonweed, contact the nearest weed control or MSU Extension office.**

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Cover photo: Rush skeletonweed;
inset: blossom in close-up

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